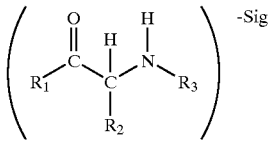
The preparation of DNA probes in accordance with another aspect of this invention can be carried out in a manner which does not require the preparation or utilization of the special nucleotides described herein. For example, double-stranded DNA can be reacted with a carcinogen or alkylating agent. After the carcinogen has reacted with or alkylated the double-stranded DNA, the resulting modified DNA is melted to produce a DNA hybridizing probe containing the reaction product of the DNA and the carcinogen or alkylating agent. When thus-modified or reacted DNA is employed as a hybridizing probe, any resulting formed double helix or double-stranded DNA would be assayed or searched out by means of a double antibody technique. The primary antibody would be an anti-carcinogen and the secondary antibody would be horseradish-peroxidase conjugated anti-peroxidase antibody. The advantage of this technique is that it would be easy to label the double-stranded DNA. This special approach is indicated hereinabove in the examples accompanying the description of this invention and is generally applicable for the preparation of DNA probes from double-stranded or double helical DNA. However, this procedure is a disruptive procedure involving the modification of the double helical deoxyribonucleotide polymer or DNA.

In the description of the special nucleotides and modified DNA employed or developed in the practices of this invention, mention has been made of mono, oligo and polysaccharides. It is pointed out that derivatives of mono, oligo and polysaccharides are also useful in the preparation of the special nucleotides of this invention. For example, it is possible to modify individual sugar moieties employed in the make-up of the special nucleotides and employ the resulting modified sugar moieties to effect or carry out additional chemical reactions. Such modified mono, oligo and polysaccharide moieties, when employed as the Sig moiety in the preparation of the special nucleotides of this invention, provide an added versatility with respect to the detection of the nucleotides or other compounds containing such modified saccharides either as the sugar S (SM) or as the Sig moiety thereof.

In another aspect of this invention the Sig moiety instead of being attached to a nucleotide could also be attached to proteins. Not only could such proteins be attached to nucleotides or polynucleotides but also such proteins could be identified per se whether attached to a nucleotide or polynucleotide or unattached. In accordance with the practices of this aspect of the invention, a suitable such protein adduct would have the formula,



wherein R_1 is an OH or an amino acid or acids and R_2 is an amino acid side chain and R_3 is H or an amino acid or acids and Sig is attached to the R_1 and/or R_2 and/or R_3.

The invention claimed is:

1. An oligo- or polynucleotide which is complementary to a nucleic acid of interest or a portion thereof, said oligo- or polynucleotide comprising at least one modified nucleotide or modified nucleotide analog having the formula

Sig-PM-SM-BASE

wherein PM is a phosphate moiety, SM is a furanosyl moiety and BASE is a base moiety comprising a pyrimidine, a pyrimidine analog, a purine, a purine analog, a deazapurine or a deazapurine analog wherein said analog can be attached to or coupled to or incorporated into DNA or RNA wherein said analog does not substantially interfere with double helix formation or nucleic acid hybridization, said PM being attached to SM, said BASE being attached to SM, and said Sig being covalently attached to PM directly or through a non-nucleotidyl chemical linkage, and wherein said Sig comprises a non-polypeptide, non-nucleotidyl, non-radioactive label moiety which can be directly or indirectly detected when attached to PM or when said modified nucleotide is incorporated into said oligo- or polynucleotide or when said oligo- or polynucleotide is hybridized to said complementary nucleic acid of interest or a portion thereof, and wherein Sig comprises biotin, iminobiotin, an electron dense component, a magnetic component, a metal-containing component, a fluorescent component, a chemiluminescent component, a chromogenic component, a hapten or a combination of any of the foregoing.

2. The oligo- or polynucleotide of claim **1**, wherein Sig comprises at least three carbon atoms.

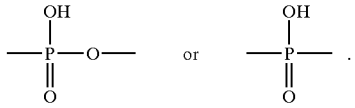
3. The oligo- or polynucleotide of claim **1**, wherein said magnetic component comprises magnetic oxide.

4. The oligo- or polynucleotide of claim **3**, wherein said magnetic oxide comprises ferric oxide.

5. The oligo- or polynucleotide of claim **1**, wherein said metal-containing component is catalytic.

6. The oligo- or polynucleotide of claim **1**, wherein said fluorescent component comprises fluorescein, rhodamine or dansyl.

7. The oligo- or polynucleotide of claim **1**, wherein said covalent attachment comprises

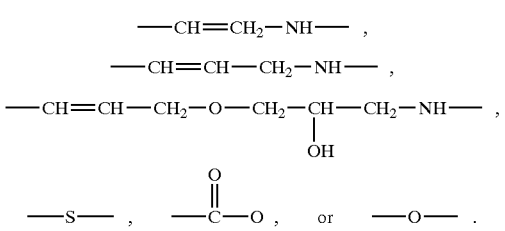


8. The oligo- or polynucleotide of claim **1**, wherein said chemical linkage does not interfere substantially with the characteristic ability of Sig to form a detectable signal.

9. The oligo- or polynucleotide of claim **1**, wherein said chemical linkage comprises a —CH_2NH— moiety.

10. The oligo- or polynucleotide of claim **1**, wherein said chemical linkage comprises an allylamine group.

11. The oligo- or polynucleotide of claim **1**, wherein said chemical linkage comprises any of the moieties:



12. The oligo- or polynucleotide of claim **1**, wherein said PM comprises a monophosphate, a diphosphate or a triphosphate.